Attachment D

Glossary

A|B|C|D|E|F|G|H|I|J|K|L|M|N|O|P|Q|R|S|T|U|V|W|X|Y|Z

cation: a positively charged ion.

clay-chemical complex: an intimate association of montmorillonite clay and an intercalant (surface treatment), wherein the intercalant ionically bonds to the clay surface. The association creates a material which is compatible with host resins, permitting montmorillonite to disperse in them.

compatibilization: the process of surface modifying a nanoclay so that it is attracted to and will disperse in resin matrices. The two most common compatibilization classes are onium ion modification and ion-dipole interaction.

exfoliate: a noun, used in patent literature to describe a surface treated nanoclay, which posesses a sufficiently enlarged gallery spacing to permit the nanoclay to fully disperse (exfoliate) in a plastic matrix.

exfoliation: a process wherein packets of nanoclay platelets separate from one another in a plastic matrix. During exfoliation platelets at the outermost region of each packet cleave off, exposing more platelets for separation. Nanoclay compatibilization is essential for exfoliation.

gallery: space between parallel layers of montmorillonite clay platelets. The gallery spacing changes depending on what molecule or polymer occupies the space.

hydrophilic: a chemical environment favoring the attraction of water or materials which are miscible in water. Hydrophilic materials are characterized by strong dipole moments. They are basically immiscible with organophilics.

Imperm®: an ultra high barrier nanocomposite plastic which features enhanced barrier to gases, water vapor and hydrocarbon fuels. Product of Mitsubishi Gas Chemical, Inc - Nanocor Alliance.

intercalant: an organic or semi-organic chemical capable of entering the montmorillonite clay gallery and bonding to the surface.

intercalate: a clay-chemical complex wherein the clay gallery spacing has increased, due to the process of surface modification. Under the proper conditions of temperature and shear, an intercalate is capable of exfoliating in a resin matrix.

interlayer space: the space between individual nanoclay platelets. It varies, depending on the type of molecules that occupy the space. Also known as "gallery space."

ion-dipole interaction: a type of chemical bond formed between a charged ion and a molecule that contains a dipole moment and a partial localized negative charge. A classic example is water of hydration in many compounds. The complex has a definite ratio of organic or polymer to clay.

masterbatches/concentrates: plastic resin pellets which contain high loadings (40-50%) of nanoclay in partially dispersed form. Masterbatches/concentrates can be letdown with additional resin to form nanocomposites with nanoclay loadings of 1-6%.

montmorillonite clay: the most common member of the smectite clay family. Montmorillonite is generally referred to as "nanoclay". It is also the most common material used in plastic nanocomposites.

nanoclay: a clay from the smectite family. Smectites have a unique morphology, featuring one dimension in the nanometer range.

nanocomposites: new class of plastics derived from a highly refined form of nanoclay that disperses in plastic resins. These nano-sized particles are composed of montmorillonite minerals.

nanocomposite technology: the materials and processes required to disperse nanoscale particles in plastics, metals, or ceramics.

Nanomer® nanoclays: surface modified montmorillonite clays, or masterbatches containing modified clays, that are utilized to make a nanocomposite. Nanomer nanoclays may be generically referred to as "intercalates" in patent literature.

nanometer: a unit of measure. One nanometer corresponds to a length which is one-billionth of a meter, or about one ten-thousandth the diameter of a human hair.

onium ion modification: the formation of a clay-chemical complex using an intercalant (surface treatment) containing an ammonium or phosphonium functional group. The groups modify a nanoclay surface by ionically bonding to it, converting the surface from a hydrophilic to an organophilic species.

organophilic: a chemical or molecular orientation favoring the attraction of hydrocarbons or materials which are miscible in hydrocarbons. Organophilic materials are characterized by weak dipole moments. They are basically immiscible in water.

platelet: general shape of a montmorillonite particle, consisting of a sheet-like structure where the dimensions in two directions far exceed the particle's thickness.

thermoplastic: plastic that softens when exposed to heat and returns to its original condition when cooled to room temperature.

thermoset: plastic that solidifies or sets irreversibly when heated.